

Civil Applications following ARGO Study:

Following the ARGO study, the ARGO Steering Committee served a valuable function as an interface between the intelligence community and the civil agencies until the abolition of the Office of Science & Technology referred to elsewhere in this paper. Arrangements are underway for a follow-on committee.

The purpose of the ARGO Committee was to (1) collect requirements from the civilian agencies for NRP photography, (2) make these needs known to the intelligence community, and (3) discuss procedures for handling classified photography with the intelligence community. The Director of Central Intelligence concurred in these arrangements.

During the period following the ARGO study the following activities occurred in the civil application of NRP photography. *A brief description accompanies each activity.*

U.S. Geological Survey Domestic Mapping Program

1. Since 1968 the U.S. Geological Survey has been systematically utilizing satellite photography to update the topographic maps of the United States.
2. To complete even the once-over medium scale (1:250,000) coverage of the coterminous U.S., by conventional map making methods, the USGS had to get the assistance of the Army Map Service on 168 sheets. Despite the subsequent rapid changes in domestic urban and transportation patterns, very little updating of this basic source for domestic construction, planning, navigation, recreational, and other economic purposes was accomplished until the current program of utilizing KH-4, and later KH-9, materials.
3. The original goal called for revising approximately 60 sheets a year, but this production level has not yet been achieved--to a considerable extent because of the still limited amount of recent synoptic-type satellite photography of the U.S. It was on the basis of this program that the Department of the Interior established the USGS Special Projects Office, a T-KH mapping center at Reston, Virginia.
4. The good results achieved on the 1:250,000 map program was followed by an interim revision program for parts of the 1:24,000 large-scale series. This series is providing updated large-scale maps of many rapidly changing urban areas.

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OCE North Carolina Dam Survey

1. In carrying out its responsibilities for inspecting U.S. dams, assigned by Congress (HR 15951) after the West Virginia dam failure, the Army Corps of Engineers (Civil Works) is currently using satellite photography.

2. A pilot study is under way to determine the location and size of dammed water bodies of over 50 acre feet capacity in an area in North Carolina. The results of the collected data, [redacted]

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[redacted] will

be subsequently field checked for accuracy.

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EPA Lake Survey

1. The Environmental Protection Agency is having satellite photography exploited to do a lake survey responsive to the new Water Pollution Control Act.

2. In policing lakes, this agency must understand the sources of pollution. It, therefore, needs agricultural, forest, and urban land use surveys of the watersheds that feed the lakes. The surveys must also identify the specific sources of pollution. Another critical point is to identify those lakes that are marginal with respect to pollution, so that remedial action can be taken before conditions become too bad, perhaps irreversibly so. Satellite photography will be used to obtain these types of data.

3. This pilot survey is also being done by  personnel, who note that much time and expense could be saved by combining the work on this project with the Corps of Engineers dam survey.

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Other Current Civil Programs

1. Forest Service Forest Management. The Forest Service of the Department of Agriculture is now actively exploring the use of satellite photography to facilitate the management of national forest resources. In the fall of 1972, during the course of the OMB-organized survey of civilian mapping by the Federal Mapping Task Force, the Forest Service representative discovered many unclassified applications of T-KH imagery-derived information were discovered once the imagery was transformed into digital tape, line drawings, or sketches. On the basis of these findings, the Forest Service now has two representatives continuing this work at the Reston facility of the U.S. Geological Survey.

2. NOS Charting Study. Since the first of the year, the National Ocean Survey of the National Oceanic and Atmospheric Administration of the Department of Commerce has undertaken an exploratory charting study at the Reston Facility. This exploratory work is part of a broad program to utilize T-KH imagery

a. in the compilation and preparation of charts of the Coastal waters of the United States and its possessions and territories.

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b. in the compilation and preparation of Aeronautical Charts of the United States and its possessions and territories.

c. to support the National Geodetic Survey program as to densification of geodetic control for the United States.

to support the U.S. Bureau of the Census in estimation of population trends, land use changes, and urban dynamics in the United States and certain foreign territories of interest.

e. to support the Coastal Zone Management program of NOAA with regard to changes in land use practices and other significant features in the coastal zone of the United States.

f. to support the programs of the NOAA National Weather Service Office of Hydrology as they relate to flood potential and water resources prediction.

g. to aid in decision-making with regard to the National Environmental Satellite Service program.

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Transportation Route Surveys

1. Satellite imagery has proved to be a useful tool in preliminary engineering surveys of transportation routes.

2. In 1966 the Engineering Strategic Studies Group of the Office of the Chief of Engineers used T-KH materials to determine two alternate feasible routes for interstate highway No. 64 through southern Indiana. The study was based primarily on KH-4 photography which was enlarged ten times. Where necessary, the imagery was further magnified optically to a scale of 1:5,000. At this large scale it was possible to lay out routes that would minimize the disruptions to existing settlements. The total volume of required cutting and filling was calculated roughly with an error of 11.5 percent. The work for this project was contracted out to the [redacted]

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3. The U.S. Geological Survey also used KH-4 photography in conjunction with a limited amount of existing maps and geological data, many of which dated back to the gold rush days, to make a preliminary route survey in April 1970 for an Alaskan pipe line from Fairbanks to the north slope oil field. This study required only four weeks to complete and has proven to be accurate. Route surveys by conventional methods would have required at least three summer field sessions and would have been very costly. During this exercise the KH-4 photography was found to be useful in extrapolating surface geology from the small areas that had been mapped in detail.

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## DROUGHT CONDITIONS IN CHILE

1. In 1968-69 both high and medium resolution satellite photography was used to support AID in studying the severity of drought in Chile.

2. This project was initiated in August 1968 by

[redacted] the AID representative on the ARGO

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Steering Group, requesting T-KH photographic coverage of snow coverage in four watersheds in the Andes of Central Chile.

Abnormally low snow accumulations were resulting in major problems of water and power supply. The level of Lake Laja had dropped by 56 feet.

3. [redacted]

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as well as KH-4 Mission 1105 (November 1968), provided photography of these areas, which was analyzed by NPIC. Imagery from a KH-4 mission in December 1966 was used as a base for determining normal conditions. The analysis was judged extremely useful for the remote water storage areas in the high Andes where neither adequate stream gauges nor lake and reservoir volume data were available. When drought conditions persisted the following year, the photographic collection and analysis effort was repeated. One problem that surfaced during this support program was the difficulty of transmitting the results of the analysis to Chilean Government without revealing the source of the information. This problem was compounded by political changes in Chile.

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## LAKE MICHIGAN - WABASH RIVER BARGE CANAL

1. In January 1969 the Engineer Strategic Studies Group of the Office, Chief of Engineers, Department of the Army, used satellite photography to ascertain the feasibility of the proposed Lake Michigan - Wabash River Barge Canal in northeastern Indiana.

2. The project outlines included several possible alignments for evaluation. The study was derived primarily from KH-4 photography and included information on the transportation facilities, population and land use patterns, vegetation and soil conditions, along the proposed alignments. These alignments were compared, and one was tentatively selected as the best. Even though the preliminary planning scope of the study did not involve detailed cost estimates, the results of the study were sufficient to indicate that the proposed canal was "most probably not feasible because of the limited water supply that is generally available from July to October and the lack of good water storage sites."

3. The actual exploitation of the KH-4 photography was done under contract by the [redacted] which was then located in Alexandria. The results of the study were initially issued at the TOP SECRET classification in T-KH control channels. The ARGO Steering Committee was briefed on the study on 9 July 1969. The report of the study was subsequently sanitized by deleting all references to satellite photography as the source of the environmental data and then released at the "For Official Use Only" level in October 1969.

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Santa Barbara Oil Spill

1. U-2 color photography was used to study the extent of the February 1969 oil spill off Santa Barbara, California, and the subsequent efforts to control its extent.
2. Within 72 hours from the time of request, U-2 photographic coverage was flown, processed, and in the hands of the responsible government agencies. The photography provided the Interior Department with useful information on damage assessment, drift pattern of the oil slick, effects of offshore currents, and effectiveness of damage abatement techniques such as log booms. In response to Interior's request, sanitized U-2 photography of the oil slick was released on an unclassified basis.

Sierra Nevada Snow Fields

1. Imagery from the U-2 tracker camera, acquired on training flights, has been used regularly since the Spring of 1969 to monitor the extent of the Sierra Nevada snow fields. The data collected in 1969 on the Kern River Basin directly affected a major water resource management decision. It was determined that there was no further danger of flood, therefore it was unnecessary to lower the reservoir levels. This decision conserved millions of gallons of water for the subsequent low-water periods.

2. This program was initiated by a request from the Department of Commerce in early 1969 for photographic coverage of the three major watersheds in the Sierra Nevadas--the American River, the Kern River, and the Kings River Basins. Commerce used the imagery to assist in forecasting the probable extent of the runoff from the accumulated snow cover. In early 1969 twelve training missions by Agency U-2 aircraft were flown over these watersheds. The resolution requirements for this project were relatively low, with the requester indicating that a 100-foot ground resolution would be acceptable, but higher resolution would be desirable. Accordingly, the T-35 Tracker Camera was used to collect the imagery over the designated areas. Negatives were sent directly by registered mail to [redacted] the Chief Hydrologist of the Sacramento River Forecast Center, who analyzed the results of each mission immediately after receipt.

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3. The imagery proved to be a very practical tool in forecasting potential water resources. To facilitate his use of the material, in April 1969 the Chairman, COMIREX, authorized Commerce personnel to release sanitized prints of the imagery in unclassified form.

4. The excellent results from the initial effort led to subsequent requests by Commerce for the 1969-1970 and 1970-1971 seasons. The number of missions required was cut down to five for the second year and one for the third year.

5. The same type of program was attempted in 1969 by T-KH imagery for the upper Mississippi and Missouri River Basins; however, this project was not nearly as successful; since major flooding had started prior to collection of the photography, and since the water management problems were different. Side-looking radar on conventional aircraft was also used on this project and was very effective in penetrating cloud cover and delineating the water-saturated areas.

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## NORTHWEST PASSAGE SUPPORT

1. In May 1969 the U.S. Coast Guard requested satellite photographic coverage to support the projected navigation of the northwest passage by the re-enforced super-tanker SS Manhattan to the Alaskan oil fields.

2. The request was initiated by the U.S. Coast Guard and endorsed by the Naval Oceanographic Office, DIA, and the Office of Science and Technology. The photography was needed to revise the coastal topography and shoreline for nautical charts and to analyze the Polar ice drift, fracture patterns, and the extent of ice pressure ridges that would influence navigation. The specific requirements included broad coverage by the three-inch index camera and spot coverage by the KH-4 panoramic camera of ice dam areas, and of the shelf ice in the Prudhoe Bay area.

3. These requirements were programmed for KH-4 Missions 1107 and 1052, with extensive coverage being obtained from the first, but unfavorable weather hampered photographic collection on the second. The U.S. Geological Survey Facility at Reston was responsible for exploiting the photography that was collected.

4. Two problems surfaced during the support effort--one of coordinating the necessary collection efforts, and the second of developing techniques

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to permit full utilization of the collected data. Specifically, DoD experienced some difficulty in simultaneously processing requirements for both the satellite photography and the SR-71  coverage that was also requested. There was also the difficulty that "Security classification prohibits the direct forwarding of this data to either Halifax or the ships. The nationalistic feelings of the Canadians dictate that the primary ice central remain in Halifax."



Corn Blight Watch

1. In 1970 satellite photography was used in the attempt to detect the spread of corn blight in the Mid-West.
2. In response to a request from the U.S. Department of Agriculture through the Chairman of the ARGO Steering Committee, KH-8 coverage was programmed in August and September 1970 for 21 areas in the U.S. Arrangements were made to have duplicate positives of the collected imagery delivered directly to the U.S. Geological Survey Special Projects Office at Reston for exploitation. This photography showed that the blight had spread to Nebraska.
3. Evaluations of the results are conflicting. A current official U.S. Department of Agriculture statement referring to the subsequent 1971 unclassified remote sensing program indicates that "healthy or slightly infected corn was accurately differentiated from moderately or severely blighted corn using photo interpretive techniques." On the other hand, one individual directly involved in a responsible position on the photo interpretation exercise indicated in a professional conference that the effort was basically not successful because the early manifestations of the blight occur at the lower levels of the corn plant while the upper levels that are visible on imagery still appear healthy.

Earthquake Damage Assessment

1. Both satellite and high-altitude aircraft photography have been used as tools to assess the extent of earthquake damage.
2. The first successful use for this purpose was by NPIC to determine the extent of the April-May 1966 earthquake damage to the Soviet city of Tashkent. In February 1971 high altitude aircraft imagery was used to study earthquake damage in Los Angeles. Here, the U.S. Geological Survey found the small-scale vertical photography to be useful, but somewhat limited in satisfying their particular requirements for detail. In January 1973, [redacted] again used successfully by NPIC to delimit the overall extent of damage by the recent earthquake to the Nicaraguan capital city of Managua. Tim McClure, the AID Diaster Relief Coordinator, was briefed on the findings and recognized the superior capabilities [redacted] over the comparable ERTS coverage. However, he indicated that his specific requirements were on a real-time basis, but he did believe that the AID senior engineer, responsible in such cases for U.S. reconstruction aid, would be vitally interested in the findings.

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Post-Disaster Damage Assessment and Pre-Disaster Planning

1. U-2 and satellite photography has been used since about 1968 to assess the extent of tornado and hurricane damage in the U.S. Specific instances of such use include the tornado area in Lubbock, Texas, Hurricane Celia, and Hurricane Camille. Under the auspices of a National Disaster Support Task Force, efforts have also been made to compile a pre-disaster imagery base that would speed up such damage assessments along the Gulf Coast.

2. The obvious advantages of synoptic imagery for such purposes led the Office of Emergency Planning in early 1968 to levy requirements for KH-4 coverage of some 115 U.S. cities. Even on a lowest collection priority basis, over 70 of these urban areas were successfully covered by October 1968, and the remaining 40 were collected soon thereafter. Among the photographed cities was Corpus Christi, which was subsequently hit by Hurricane Celia on 3 August 1970. Photographic coverage by U-2 aircraft graphically portrayed the extent of the Mississippi area affected by the 1969 Hurricane Camille.

3. As a result of these efforts, two actions were undertaken by the ARGO Steering Committee. The first was to appoint a National Disaster Support Task Force under the chairmanship of OEP to devise

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a mechanism to coordinate photography coverage of natural disaster areas required by the various agencies and to establish a means for the dissemination and interpretation of this photography on a timely basis. In addition, U-2 coverage of the entire Gulf Coast was acquired for use as a data base for damage assessment. This photography was also used by the U.S. Geological Survey for map revisions.

## WHALE CALVING AREAS

1. On 30 November 1972, [redacted] of the Office of National Marine Fisheries requested overhead photographic coverage of two areas which he wanted searched for whales.

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2. The two areas covered a total of about 50 square miles off the west coast of the lower California Peninsula, Mexico, specifically Laguna San Ignacio (26° 50'N, 113°11'W) and Laguna Scammons (27°40'N, 114°7'W). The objective was to search for the presence of whales during the calving period between 15 and 30 January 1973. The adult females range in size from 25 to 60 feet and the pups from 6 to 12 feet.

3. The requirement was programmed [redacted] and the request was also passed on to [redacted] to determine whether the U-2's could be used during a training mission. NPIC analysis of the satellite acquired photography did locate approximately 19 whales in one area and 8 to 10 in the second area.

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